



U.S. Army Corps of Engineers
Engineering and Support Center, Huntsville
P.O. 1600
Huntsville, AL 35807-4301

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Line of sight technology speeds process of modernizing Army training ranges

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**By Debra Valine
Huntsville Center
Public Affairs Office**

As the Army incorporates new weapons systems into its inventory, training ranges must be updated to provide the best possible and most realistic training venues to support the Army's "train as we fight" philosophy.

On the larger more complex digital ranges, the footprint or "baseline to target box" can comprise up to 6,000 acres of land. More challenging, our Soldiers are required to acquire, engage and hit stationary and moving targets at distances out to 2,400 meters in a time sequence/scored process.

"As engineers, we must ensure Soldiers can see or 'engage' specific targets at the required distances without visual obstructions (landforms and vegetation) in order to achieve the strict training standards within the allotted time," said Mark Fleming, program manager, Army Training Facilities Program Office at the U.S. Army Engineering and Support Center in Huntsville, Ala. "This is known as line-of-sight, a critical element in the design and construction of these large expansive range facilities."

Target matrixes are developed by Army trainers during the early design process to determine minimum target engagements to meet Army Training Standards. In the past, it would take a long time to develop a line-of-sight analysis for the range simply because it took four to five days to run the computer modeling program. The answer would come

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back as a yes the engagement could be engaged, or no it could not be seen from that position. If the answer was no, it was back to the drawing board for the range designers to reorient the firing positions and target objectives. In some cases, this iterative process could take weeks of combined dedicated effort from the trainers and the engineers working closely together to obtain a satisfactory design solution.

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Today, Huntsville Center's Range Center of Expertise is using a line-of-sight design analysis program developed by HNTB Corps of Kansas City, Mo., that runs much faster and incorporates the newest training requirements. Line of sight integrates planning, designing and building of larger, more complex ranges. Line-of-sight analysis is essentially a visual line of sight between firing points and the target positions, which is critical to allowing Soldiers to achieve standard training.

"Applying this tool saves time and reduces the cost of constructing military training ranges, reduces contact with unexploded ordnance, reduces environmental impact and optimizes training by making it more realistic," Fleming said.

"There are four proven case studies where the Huntsville Center went in and saved four ranges that were in trouble," Fleming said. "We used those ranges as a baseline to test the LOS design tool and the results have been outstanding. We were being called in when projects were in design or nearing construction and were in trouble. Now we want to get in at the start of the design process to optimize the benefits for the range."

The four case studies proved that value is added by using a line-of-sight analysis.

- The traditional six-year schedule for designing and building a range could be reduced to four years.
- Training capability was improved by optimizing training scenarios for multiple platforms (Abrams, Bradley, Scout, and others) through balanced target utilization, increased utilization of targets from firing positions and increasing effectiveness of training on trails.
- An average of \$2-4 million cost avoidance per range could be realized by reducing unnecessary earthwork, design optimization, reduction in unexploded ordnance/environmental mitigation and impacts, and maintenance.
- Environmental impact could be reduced by 10 to 30 percent.
- The ranges provided flexibility in training scenarios in order to minimize impacts to other adjacent facilities by increasing target availability by 10 to 25 percent.
- Unexploded ordnance impacts could be reduced 10-30 percent.

"We want to use this software to change the way the Army designs ranges and implement a new design approach," said Lary Quick, a technical manager in the Engineering Directorate at the U.S. Army Corps of Engineers, Engineering and Support Center in Huntsville, Ala. "Using this software we can go through as many iterations as necessary to optimize training for the Soldier, reduce cost, etc."

Huntsville Center is the Corps' Mandatory Center of Expertise for Ranges. The Center:

- Central Engineering consultant to Army for training facilities
- Provides standard design drawings and manuals for Army automated ranges, prepares DD Form 1391 for Army G3 funded projects, performs technical review, design review for target interface compliance, construction interface inspections and line-of-sight analysis.

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- Provides the complete spectrum of range design services for the U.S. Army, U.S. Marine Corps, Army National Guard and the U.S. Army Reserve Components.

- Supports the Department of the Army in the development of a comprehensive Master Range Plan that correlates mission training needs with well-designed ranges and training areas.

In the past 16 years, Huntsville Center has helped with the construction of more than 600 ranges.

“In the mid-1980s, we had a line-of-sight program that we ran on a local computer that went to a larger computer in the building and then to a Cray super computer in Maryland,” Quick said. “We got an answer back in about three-four days – the answer was either yes you can see the target or no, you cannot see it.

“As the ranges became more complicated and larger in scale, that answer did not suffice,” Quick said. “To meet training requirements, we needed to know more than just yes or no. So we went out to get a computer analysis program written that would meet our specific needs. In the late 1980s, Intergraph Corp. of Huntsville created a triangulation model – a 3-D computer model, and then they created a graphical user interface (GUI) between the computer screen and the 3-D model that allowed us to see the profile of the line of sight. From that, we generated reports that told us yes or no, something about the line of sight – distance between firing point and target, elevation, angle, etc.

“Every time they came out with a new operating system for our computers, we had to have our software rewritten to keep up with it,” Quick said. “It started out taking 24 hours to run a line-of-sight analysis somewhere in the neighborhood of 1/2 million profiles. We have upgraded several times and we are now using software that we are leasing from HNTB. This software – True/Viz™ On Target – can run the 1/2 million profiles in less than five minutes. This is the software we are using with the three test ranges we are working on.” The test ranges – scheduled for construction in 2008 – one each at Fort Riley, Kan., Fort Stewart, Ga., and Yakima Training Center, Wash. Each range will take about 18 months to build and then six months for instrumentation.

HNTB had written the existing software and, based on a strong partnership with the Huntsville Center, adapted it to fit Huntsville Center’s needs. Not only does it provide the profile between firing position and targets, it incorporates all the training tasks in the various Army Field Manuals. It provides the combinations that will need to be used to get the training task accomplished by helping lay out ranges that fit the requirements of the training tasks.

“We can run the analysis on existing ranges and tell them which ranges meet the training requirements,” Quick said. “Because we can run the profiles so quickly, we can run the analysis over and over and change it a number of times to meet training requirements. It costs about \$30 million to build a new range. This brings down the cost to build the range by avoiding massive quantities of earthwork for one example.”

Using this program, the range can be designed much faster than it could be using traditional design with computer aided drafting (CAD).

“We can cut design time,” Quick said. Ranges get looked at for rebuilding on a cycle of every 10-15 years. There are always new training range requirements based on

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stationing of units, which changes with initiatives such as Base Realignment and Closure (BRAC) and military transformation.

These ranges support training on tanks, Bradley Fighting Vehicles, Strykers, HUMVEES, Scout vehicles. The software has the capability to be used for small arms range development, but has not yet been used by Huntsville Center for that.

In the past six months, armor training requirements and standards have changed dramatically, Quick said. “We put in the new training requirements and standards. We now have the ability to go back to finished designs to ensure they meet current training requirements before the ranges are actually built.”

“The objective of the prototype effort is to introduce a new engineering design process leveraging computer technology to provide our Soldiers with a higher quality, more flexible training venue,” Fleming said. “The results will be apparent in approximately three years when these projects are turned over to conduct live-fire operations.”

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Photo caption:

Realistic training prepares Soldiers for future missions. U.S. Army photo.